

Space Weather Technical Forecast

Issued on Sunday, 29 January 2023 at 00:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales <https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales>

Space Weather Forecast Headline: Slight chance of R1/R2 Radio Blackouts. Slight chance of G1/Minor Storm Day 4 (1 Feb).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with occasional C-class flares, the largest a C3 at midday UTC from AR3200 in the northwest. There are currently seven sunspot regions on the visible disc, all of which are small and simple. Two regions in the northwest and southwest have shown slight growth, otherwise remaining regions are either stable or in decay.

No Earth-directed CMEs were detected from available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by DSCOVR, has varied between 490-570 km/s. Density remains at average, occasionally slightly above average, levels. The total IMF, Bt, was weak as was the north-south component, Bz, which fluctuated weakly between +5/-5nT. The phi angle was positive (away from the Sun). Geomagnetic Activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has been at background levels throughout. High energy electron flux (greater than 2 MeV) has been at background to moderate levels, peaking at 589pfu at 28/1825UTC. The associated 24-hour integrated electron fluence has drifted upwards but remains well below the Active threshold, with 1.75 e7 integrated pfu observed at 29/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity probably remaining Low, with a slight chance of an M-class flare throughout the four day period.

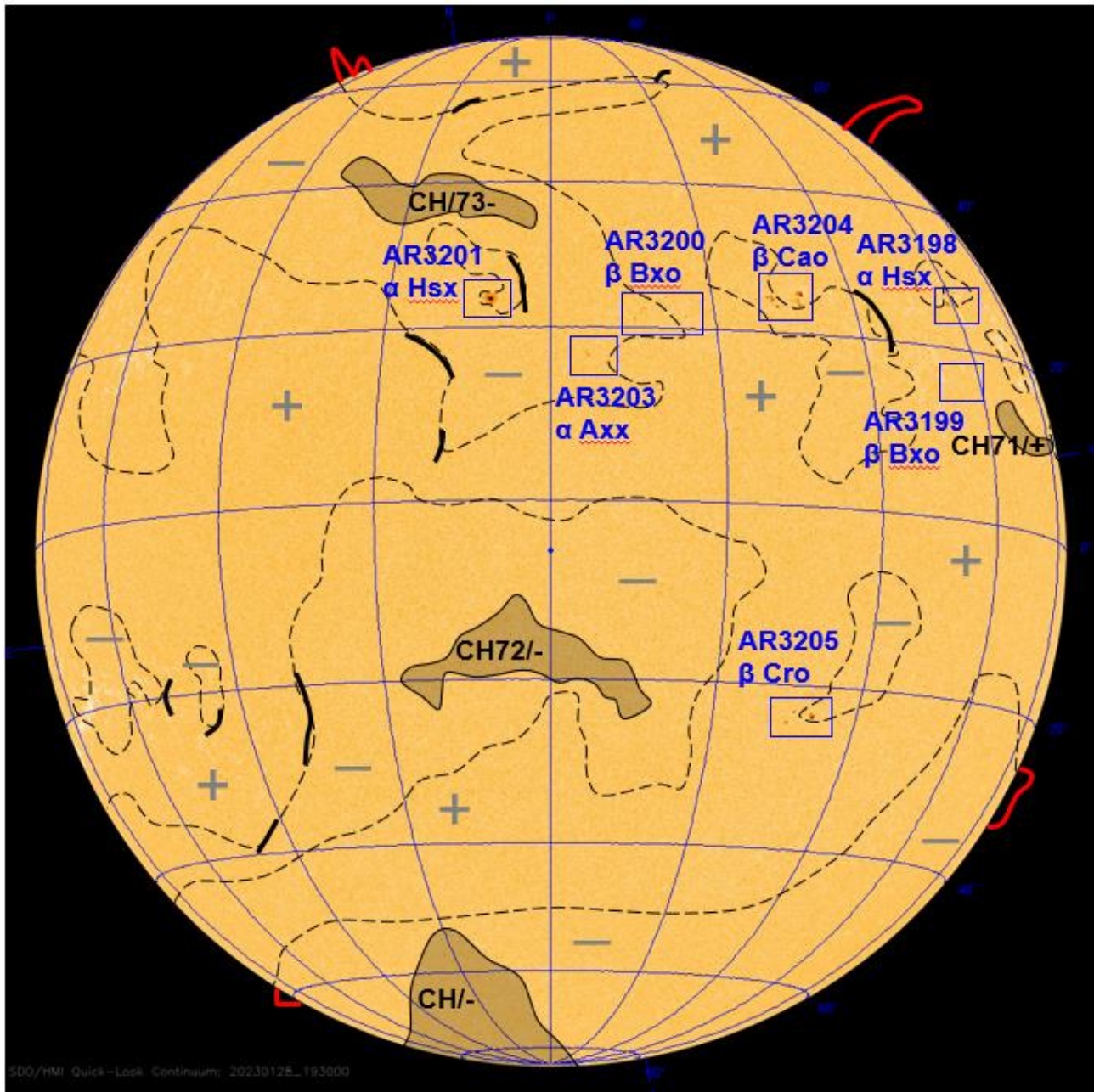
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are currently expected. Solar winds, initially at elevated levels through Day 1 (29 Jan), are expected to show a gradual decline in the coming days, perhaps to slow-ambient levels by Day 3 (31 Jan). A further pair of negative polarity coronal holes, CH72 and CH73, may start to give an increase in wind speeds from later on Day 3, but it is more likely to occur Day 4 (1st Feb).

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 0-3) for much of the period. From Day 3 (31 Jan) a slight (5-10%) chance of G1/Minor Storms (Kp 5) has been indicated assuming we do see further HSS influence.

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES16 is expected to remain at background levels. Electron flux is likely to increase through the period as the HSS wanes. Fluence is likely to show an increasing trend over the next couple of days, with a slight chance of reaching the Active (1e8 integrated pfu) threshold, although this is low confidence

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

Figure 1. Solar Analysis Valid 28/2000 UTC.



Key: Filament — , Prominence — , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α - β - γ - δ and Zurich-McIntosh Axx etc.

Geomagnetic Storms:

No Earth-directed CMEs are currently expected during this period.

Coronal Hole High Speed Stream influence continues. Solar winds, initially at elevated levels through Day 1 (29 Jan), are expected to show a gradual decline in the coming days, perhaps to slow-ambient levels by Day 3 (31 Jan). A further pair of negative polarity coronal holes, CH72 and CH73, may start to give an increase in wind speeds from later on Day 3, but it is more likely to occur Day 4 (1st Feb).

Geomagnetic activity is expected to be Quiet to Unsettled (Kp 0-3) for much of the period. From Day 3 (31 Jan) a slight (5-10%) chance of G1/Minor Storms (Kp 5) has been indicated assuming we do see further HSS influence.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	5	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected.

Radio Blackouts - X-Ray Flares:

Solar activity has been Low with occasional C-class flares, the largest a C3 at midday UTC from AR3200 in the northwest. There are currently seven sunspot regions on the visible disc, all of which are small and simple. Two regions in the northwest and southwest have shown slight growth, otherwise remaining regions are either stable or in decay. Some bright flux at the southeast limb of STEREO-A imagery may indicate a possible active region that could rotate around the limb in the coming few days. Solar activity is expected to continue predominantly Low with a slight chance of an isolated M-class flare.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) protons as observed by GOES-16 are currently expected to persist at background levels. The remaining regions on the visible disc are all small and simple, and therefore unlikely to give any significant increase in proton counts.

Radiation Storms	Level (cm ⁻² sr ⁻¹ s ⁻¹)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	2	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = cm⁻²sr⁻¹s⁻¹)

High Energy Electrons Event ($\geq 2\text{MeV}$):

High energy electron flux (greater than 2 MeV) is currently varying diurnally between background and moderate levels. This is likely to show an increase as the HSS influence wanes and the radiation belts de-compress, although the level of any increase depends on how much charging has taken place during the current fast wind.

The associated 24 hour fluence is likely to show an increasing trend over the next couple of days with moderate confidence. There is a slight chance of reaching the Active ($1\text{e}8$ integrated pfu) threshold, although this is low confidence. REFM is currently forecasting an increase below Active up to Day 2 (30 Jan) which seems reasonable. Fluence did reach above Active on the previous rotation, but electron flux was higher at the equivalent of this point in time previously so levels are expected to be correspondingly lower this time around.

GEO Electron Environment	Level ($\text{cm}^{-2} \text{sr}^{-1} \text{day}^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^8$	No	1	10	20	20
Very Active	$\geq 2 \text{ MeV}$ $\geq 1 \times 10^9$	No	1	1	1	1

Figure 2: MOSWOC REFM

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